STRATEGY RESEARCH PROJECT

DEVELOP A BETTER SIMULATION STRATEGY FOR ARMY AVIATION

BY

COLONEL GREGORY A. ADAMS
United States Army

USAWC CLASS OF 2000

U.S. ARMY WAR COLLEGE, CARLISLE BARRACKS, PA 17013-5050

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Gregory A. Adams
Colonel, U.S. Army

Colonel Robert M. Stewart
Project Advisor

U.S. Army War College
CARLISLE BARRACKS, PENNSYLVANIA 17013

ABSTRACT

AUTHOR: Gregory A. Adams

TITLE: Develop a Better Simulation Strategy for Army Aviation

FORMAT: Strategy Research Project

DATE: 10 April 2000   PAGES: 48   CLASSIFICATION: Unclassified

Aviation modernization programs do not assure that Army aviation forces will remain trained and ready. Modernization programs for Army helicopters throughout the 1990s did not include upgrades to the fleet of supporting training devices leaving them outdated.

The U.S. Army currently operates a fleet of 36 high fidelity helicopter flight simulators at 17 sites around the world to include the continental U.S., Alaska, Hawaii, Germany and Korea. Fielding of these devices began in 1980 through 1996 and represents an investment of more than $600,000,000. Army Aviation has relied and continues to rely on these simulators for initial and sustainment training. But the computation systems, image generation and instructional system technology used in these simulators is approaching 20 years in age, and has been in great need of modernization for many years. After nearly a full decade of under-funded flight training and research, development and acquisition, Army aviation readiness is down. This represents a significantly increased operational risk to the aviation mission. A partial cause of the reduction in Army aviation readiness is outdated flight simulators.

The Fiscal Year (FY) 2000 Army budget requested $1.23 billion dollars to procure aircraft, aircraft modifications, spares, repair parts and related support equipment and facilities and support an Army Aviation Modernization Plan (AAMP). The AAMP's centerpiece is the fielding of the Comanche helicopter and the upgrade of 530 of 746 Apache helicopters to the Longbow configuration. In addition, the AAMP seeks to reduce operating and support costs by replacement and upgrade of existing systems with information age technology and investment in cutting-edge technologies. But the plan has shortcomings. It says it will replace and upgrade existing systems but legacy flight simulators for the UH-60, AH-64, and CH-47 have not received significant upgrades in over 10 years. Because they are so outdated, their cockpits no longer replicate to the degree required, the configuration of the actual aircraft. As a result, flight simulator operating costs are higher than they should be, training realism is being lost, and a significant increase in risk has occurred due the negative habit transfer between existing simulators and actual aircraft.

Two Four Star Commanders and Congress recognized the flight simulator problem. A $9.3 million appropriation for upgrade of the Eight U.S. Army's UH-60 and CH-47 simulators in Korea was approved without the Headquarters, Department of the Army asking for funding. Despite apparent support in Congress, the Army's budget does not address legacy simulator upgrades. The Army should implement regulatory changes for modernization programs that also invest in training resources by linking aviation training device upgrades to aircraft modernization programs.

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INTRODUCTION

Today, after nearly a full decade of under-funded flight training and research, development and acquisition, Army aviation readiness is down.[1] This represents a significantly increased operational risk to the aviation mission. A partial cause of the reduction in Army aviation readiness is outdated flight simulators.

> "The U.S. Army currently operates a fleet of 36 high fidelity helicopter flight simulators at 17 sites ranging from the continental U.S., to Alaska, Hawaii, Germany and Korea. These simulators . . . were acquired at a total acquisition cost of more than $600,000,000 beginning in 1980 through 1996. Army Aviation has relied and continues to rely on these simulators for initial and sustainment training. Computation system, image generation and instructional system technology used in these simulators is approaching 20 years in age, and has been in great need of modernization for many years."[2]

This paper will identify shortfalls in the current simulation strategy that affect aviation readiness and will address the current status of the pilot population and the Army's flight simulators. In addition, this paper will recommend an integrated strategy for army aviation simulation and simulators, discuss why flight simulator upgrades should be a top priority for upgrade and funding, and finally, to discuss what regulations and cultural norms the Army needs to change to successfully implement the strategy.

The current simulation strategy for Army aviation has failed. Why it has failed is related to how the Army manages training aids and devices and dramatic cuts in defense spending. Today, the thirty-six high fidelity helicopter flight simulators, critical training devices, for the AH-64 (Apache), UH-60 (Blackhawk), and CH-47 (Chinook), the so-called legacy systems, have outdated technology and cockpit environments that negatively affect the Army's ability to perform its aviation mission worldwide. Outdated flight simulators and a downward trend in funded aviation training (flight hours) over the last several years have combined with a loss of pilot experience (retiring Vietnam era aviators), increasingly complex aircraft and mission profiles that lead to a reduction in Army Aviation readiness. This problem will take years to correct.

This readiness problem was highlighted in a recent Army Times article entitled, Army Aviation Leaders Claim Branch in 'Crisis'. One of three general officer aviators said the problem in Army aviation is so critical that the branch is literally at risk of being "able to fulfill the strategic and tactical vision that the Army has" for it to accomplish.[3] Recent negative commentary about the readiness of Task Force Hawk (Albania) and its support to Operation Allied Force in Kosovo, further highlights the serious aviation training issues facing the Army. Although the senior aviation leaders in the Army Times article suggested that 'improved training and modernization' is required, there was little apparent consensus on a strategy to achieve that end.[4] Symptoms of the broader readiness issues are higher accident rates, aging

equipment, low pilot retention and recruitment, and outdated training facilities and devices (flight simulators).

In messages to the Department of the Army, Four Star commanders in Korea and Germany have voiced concerns about the problems with flight simulators used to train pilots and requested funding to upgrade them. Although the Army did not fund the requests, Congress provided $9.3 million to the Eighth Army (EUSA) in Korea to upgrade the UH-60 and CH-47 flight simulators. The United States Army Europe (USAREUR) also requested funding for simulator upgrades, but no funding has been approved to date. The USAREUR Commander considers the upgrade of the flight simulators one of his top three priorities to solve issues in the European Theater related to Task Force Hawk.[5]

The independent efforts of these Commanders, although extremely important, are fragmented attempts to fix an Army-wide problem. It is further proof of a strategy that failed to synchronize aircraft modernization programs with upgrades of critical training devices that some Army's most senior field commanders, by their own efforts to obtain simulator upgrades, have deemed essential to aviator training.

WHY IS THERE A SIMULATOR UPGRADE PROBLEM?

The failure to upgrade flight simulators is rooted in the massive defense cuts following the end of the cold war that forced tough budget decisions for senior Army leaders. Due to the U.S. Government's effort to capitalize on the so-called peace dividend, "the defense budget has been cut for 14 years, resulting in a growing requirements mismatch. Short-term readiness has been maintained by mortgaging future readiness accounts. Modernization, recapitalization and replacement of aging equipment are all in need of increased funding."[6] Although simulators and simulation devices already in the field were maintained out of Operations and Maintenance (O&M) dollars, upgrades to them are new procurements and have to be funded by different accounts. Procurement funding is normally part of the Research, Development and Acquisition (RDA) process.

> 'RDA consists of Procurement and Research, Development, Test and Evaluation (RDTE). Since 1989 however, RDA has declined 43 percent in real terms. By the middle of the 1990s, aging and obsolescent equipment indicated a need for investing in equipment modernization but this didn't happen because of two reasons; continued reductions in defense spending in real terms and diversion of defense dollars to cover increased O&M costs for troop deployments to Bosnia and Southwest Asia. Since 1989, the Army has provided over 60% of the forces for 32 of the 36 major deployments while at the same time its force structure was reduced by 33 percent, and modernization buying power dropped by 44 percent.'[7]

WHAT IS THE STATUS OF THE ARMY'S FLIGHT SIMULATORS?

Throughout the 1990s, selected modernization programs have upgraded the cockpit configuration and system capabilities of the AH-64, UH-60, and CH-47 helicopters. But, the limited aircraft modernization, in nearly all instances, occurred without corresponding upgrades to the flight simulators that replicate them. Therefore, while the Army was successful in some helicopter modernization, critical

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training devices were not linked to these modernization programs and did not receive upgrades. As the simulation community notes, today's flight simulators lack *concurrency* with the actual aircraft.

The Army Aviation Warfighting Center's biannual Functional Area Assessment for the Vice Chief of Staff of the Army rated aviation training aids and devices 'Red' overall.[8] Further analysis of flight tasks by the Army Aviation Center performed on the flight simulators (FS) for the AH-64, UH-60 and CH-47 show negative habit transfer exists that could significantly increase risk increases when operating them. The analysis then subjectively rated the AH-64 CMS 'red', and the UH-60FS and CH-47FS as 'amber' on a green, amber, and red rating scale.[9] The Army color codes ratings for easy reference and traditionally quantifies them as follows: green is 80% or greater, amber is 60% to 79% and red is anything 59% or less. The Apache is the most complex of the aircraft and has had the most changes made to it. In addition to a lack of concurrency, the computer technology that operates the flight simulators is outdated and more costly to operate and maintain than current technology can provide.

> "There are several subsystems embedded in the Army's flight simulator inventory that have been bypassed by newer technology. The technology used in these subsystems is 18 plus years old and many of the critical subsystems have been replaced by less expensive, cheaper to operate, more reliable, and easier to maintain equipment. The advances made in this equipment are comparable to the advances made in your PC over the same period of time. Moore's Law, the maxim, states the computers double in speed in half the cost every eighteen months. Who would consider continuing to operate with the first PC that they started with over 15 years ago?"[10]

WHAT ARE THE LEGACY FLIGHT SIMULATORS

The AH-64 Combat Mission Simulator (CMS) is a full motion, high fidelity flight simulator with six degrees of freedom (DOF). The six DOF provides a platform that allows pilots to practice individual and crew training tasks, some gunnery skills, and emergency procedures with the feel of the actual aircraft in flight. The CH-47 and UH-60 flight simulators (FS) also provide a six DOF platform motion capability. Combined, the AH-64 CMS, UH-60 FS, and CH-47 FS require over twenty-one (21) significant changes to configuration or capability to achieve concurrency of cockpit configuration. The AH-64 CMS requires thirteen, the UH-60 FS requires five (5) and the CH-47 requires three (3) configuration/capability changes.[11]

Arguably, the legacy flight simulators are three of the most critical tools in the U.S. Army for training pilots. The acquisition strategy notes that the AH-64 CMS "is an invaluable crew trainer as it saves thousands of flight hours annually while providing realistic combat mission training scenarios and emergency procedures. Upgrades have been identified but have not been funded."[12] The lack of simulator upgrades, however, significantly increases risk to flight safety. Cost of flight training also increases because fewer tasks can be properly trained in a non-concurrent simulator and therefore, must be trained in the actual cockpit. For helicopters without flight simulators like the Apache Longbow and the Kiowa Warrior, additional flight hours in the aircraft are required by each pilot to offset the lack of a flight simulator. Because simulators are significantly cheaper to operate than actual aircraft, training costs

invariably increase. Training risks, without a simulator to train hazardous tasks and emergency procedures, also increase.

EFFECTS OF NON-CONCURRENCY

Training Circulars (TC) 1-212 UH-60, 1-214 (AH-64), and 1-216 (CH-47) mandate that each aviator will fly a certain number of flight hours in a flight simulator every six months. Flight hours obtained in a simulator allows emergency procedures and other tasks too hazardous to train in the aircraft (e.g. engine and tail rotor failures) to be performed safely in a risk free training environment. Such training not only reduces the amount of training required in the actual aircraft, which saves money but also allows pilots to learn to deal with emergencies safely. Therefore, training in a flight simulator would ordinarily reduce risk. But today, because there are great differences between the simulator and actual cockpit configuration, known as a lack of concurrency, the risk to pilots and crews significantly increase. The increased risk is due to the negative habit transfer pilots experience when moving between cockpits that lack a concurrent configuration.

Risk comes in multiple forms but there are two primary risks that are apparent when a flight simulator required for training is different from the actual cockpit. First, there is increased risk from performing flight skills training in actual aircraft that could otherwise be taught in the simulator before attempting them live for the first time. Performing initial flight tasks in the live cockpit without first reviewing them in a simulator increases risk exposure to both student and instructor pilot. The second and most critical risk factor is the negative habit transfer that occurs when pilots fly cockpits of dissimilar or slightly different configurations. In other words, the aircraft looks the same externally and will fly the same way, but not all the switches, systems, and radios are the same nor are they in the same location inside the cockpit. This happens now due to the lack of concurrency between the aircraft and the flight simulators the Army now has in the field.

Negative habit transfer is an extremely critical problem. It causes a pilot, whose actions should be instinctive from years of training, to have to think rather than react instinctively to any situation. The condition of negative habit transfer may cause even routine training missions to be at a higher risk than they should be. It is particularly dangerous in an emergency situation that limits the time a pilot has to react to a potential deadly situation. To reduce the risks inherent in the demanding missions pilots are expected to fly, Army aviators train to perform numerous individual and collective tasks in realistic situations. A pilot's actions become instinctive in reacting to the various situations from habitual training in a standard cockpit configuration where every switch, dial, and indicator is in the same location. Factors that disrupt habitual training factors, like cockpit configuration, significantly degrade the long-term reinforcement of critical pilot skills. A standard simulator cockpit configuration, concurrent with the aircraft, is critical to preventing negative habit transfer. Configuration is affected by form, fit, and function. Of those, two will be addressed.

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Function: When a new radio is installed in the aircraft but not in the simulator, the training realism is reduced between the simulator and the aircraft. Since radio usage is standard procedure, the pilot learns how to use the radio in the simulator to complete that training but doing it does not reinforce the associated tasks such as turning and preparing the radio for operation in the aircraft. Form: Even if the radio in the actual aircraft is the same as that in the simulator, the location of it often is in a different location in the aircraft than in the simulator. When that happens, the pilot must scan to find the spot where the radio is located in each cockpit rather than be comfortable that both have the same features, equipment and is in the same place. Again, reinforcement of tasks required to safely operate key and essential equipment of the actual helicopter is routinely lost because the Army's simulators lack concurrent cockpits. That problem underlies an even greater concern; flight safety.

A pilot whose years of training is undertaken to develop the instincts to reduce risks of flight operations is receiving conflicting sensory inputs between the differing cockpit configurations of the actual aircraft and the non-concurrent flight simulator. This conflict is, in effect, negative training. The conflicting sensory input erodes the instinctiveness developed from the routine and repetitive training designed to instill quick and proper pilot reactions to various situations. The more time a pilot consumes in thought processes when reacting to a situation versus the instinctive responses developed through training is the crux of the negative habit transfer problem. Even though small differences between the actual aircraft and a non-concurrent flight simulator may seem trivial or insignificant, because of the potential effects of negative habit transfer, they are often very significant. This is particularly true in the Army's pilot population today. Any additional time a pilot requires in thought to identify a radio, switch or indicator, just to take a routine action that should otherwise be instinctive from years of training, particularly in time pressured events, adds critical time a pilot may not have to react safely to a situation.

The most serious hazards to flight are most often outside the cockpit and the pilot and crew must have a division of attention that keeps focus outside as much as possible. Negative habit transfer creates a change in the division of attention a pilot uses to manage the visual and audio cues from inside and outside the cockpit. That is inherently dangerous. If a pilot spends more time with eyes focused inside the cockpit, instead of outside where the hazards to flight are located, the risk of hitting the ground, another aircraft, tree, wires, etc. increases dramatically. Although dangerous, that is an accepted routine because simulators lack concurrency with the aircraft they replicate and simulator training is mandatory. Just to locate a radio that might be in a different location in the aircraft versus the simulator increases risk. The Army, by its failure to upgrade flight simulators, has set the training conditions that increase the probability a pilot may react improperly (pilot error) to a given situation. Since most aviation accidents in the Army today are attributable to pilot error, every effort to mitigate its causes should be vigorously pursued. Training Circular 1-210, notes that

> "Under high time stress, crew members rely on a pattern-recognition decision process to produce timely responses. They minimize deliberation consistent with the available decision time. Crewmembers focus on the most critical factors influencing their choice of responses. They efficiently prioritize their specific information needs within the available

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decision time. . . .Crew actions reflect extensive rehearsal of emergency procedures in prior training and pre-mission planning and rehearsal."[13]

But, the desired effect 'extensive rehearsal' aims to achieve is not reinforced to the extent possible by simulator training because they require upgrades. Hovering over the treetops with troops on board, the negative habit transfer that the Army accepts today detracts from a instinctive 'pattern recognition decision process' that could cause a pilot and crew to not only spend more time inside the cockpit, but to react more slowly to a potentially critical situation that may mean the difference between a safe recovery and a serious, even fatal accident. In other words, the problem of negative habit transfer between the Army's simulators and actual cockpits can ultimately be a killer. In fact, some soldiers in the field think that such a scenario was possible and even likely in an accident that destroyed one helicopter and killed seven (7) soldiers in 1999. Therefore, for no other reason than to eliminate the negative habit transfer between the actual aircraft cockpit and flight simulator, the Army should invest in legacy flight simulator upgrades now.

FY 2000 ARMY AVIATION MODERNIZATION PLAN LACKS LEGACY SIMULATOR FUNDING

The importance of our legacy flight simulators to aviation readiness appears to have lost significance among competing priorities in the Army. Currently, no apparent systems or regulations have been identified that mandate critical training devices to remain concurrent with modernization programs of fielded aircraft. Consequently, no significant modernization of the legacy flight simulators occurred throughout the 1990s. Ironically, during the same time period, the Federal Aviation Administration (FAA) began to more fully exploit the potential of flight simulators to save money, reduce training risks, and improve overall safety.

> "The availability of advanced technology has permitted greater use of flight simulators for training and checking of flight crewmembers. The complexity, costs, and operating environment of modern aircraft also have encouraged broader use of advanced simulation. Simulators can provide more in depth training than can be accomplished in airplanes and provide a very high transfer of learning and behavior from the simulator to the airplane. The use of simulators, in lieu of airplanes, results in safer flight training and cost reductions for the operators. It also achieves fuel conservation and reduction in adverse environmental effects."[14]

The FAA recognized the potential of flight simulators and funded enhancements and improvements while the Army was struggling just to keep adequate training programs in place. Now, in certain high fidelity, full six degrees-of-freedom (DOF) simulators, the FAA routinely conducts all flight training to include final pilot certification. While not advocating the Army conduct all manner of flight training in a simulator like the FAA does in some instances, the training potential that high fidelity simulators can provide is much greater today than at any time in history. With relatively low cost upgrades proposed by the Simulation, Training and Instrumentation Command (STRICOM), the legacy flight simulators could provide enhanced realism, lower costs, and mission rehearsal capability in a near

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risk free environment. The Army already knew the capability of high fidelity flight simulators to provide increased training value, risk reduction, and cost effectiveness but did not invest in upgrades for its 36 devices. Had the Army invested in upgrades to flight simulators, training constraints experienced by aviation units in the form of environmental restrictions, limited operating times, and reduced flight hours, particularly for units in Europe, could have been partially offset by the increased use of upgraded flight simulators. In addition, the readiness implications of recent groundings of the AH-64 and CH-47 helicopters could also have been more effectively addressed with upgraded flight simulators. Upgrades with a mission rehearsal capability could have provided the pilots of Task Force Hawk the opportunity to better prepare to operate in the mountains of Albania; some of the most challenging terrain ever flown by Army aviators. Looking at the current budget, however, it is unlikely that this situation will change in the near future.

The Fiscal Year (FY) 2000 Army budget requested $1.23 billion dollars to procure aircraft, aircraft modifications, spares, repair parts and related support equipment and facilities. According to the Association of the United States Army (AUSA), "First, the army is pursuing a focused modernization effort that will seek to reduce operating and support costs by replacing aging systems, upgrading existing systems with information age technology, and investing in cutting-edge technologies."[15] The Army Aviation Modernization Plan (AAMP) provides the Army's strategy to meet the challenges of the 21st century. The plan is supposed to balance priorities and minimize risk while focusing on fielding the Comanche helicopter as the top aviation modernization priority. The plan also notes that 530 of the Army's 746 Apache helicopters will be upgraded to the D Model known as the Apache Longbow with the remaining 216 AH-64As sent to the National Guard, unless congress approves additional funding for longbow modernization.[16] A Longbow Crew Trainer (LCT) is a simulator being developed for the Longbow Apache (AH-64D) to replace the CMS. But, the budget does not appear to address legacy simulator upgrades identified by both the Eighth Army Commander and United States Army Europe Commander as essential requirements in their areas of responsibility.

The lack of funding to upgrade all Apaches to the Longbow configuration creates a more complex problem for the Army, in addition to the issue of sustaining two dramatically different Apache configurations in the training and maintenance base. The Program Manager (PM) Advanced Attack Helicopter under the Program Executive Officer (PEO) for Army aviation at Redstone Arsenal, Alabama is the materiel developer for the LCT; a deployable training device of lower fidelity designed to replace the Apache CMS. If the Army does not get additional funding to upgrade all AH-64 aircraft, it either must create a Modified Longbow Crew Trainer (LTC-M) to provide a simulator for the AH-64A Apache in the reserve component (RC) or upgrade a number of Combat Mission Simulators (CMS) that are regionally situated to support RC Apache units. This is a significant long-term readiness and cost issue.

Apache Longbow (AH-64D) fielding began at Fort Hood in October 1998. The fielding of twenty-three (23) LCTs was supposed to begin with Fort Hood in September 1999 but initial delivery was slipped one year. One LCT is to be provided to each Longbow Apache Battalion. The current program is

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considered to be low risk despite fielding delays amounting to one year behind the original schedule. In addition, the fidelity of the device, which is not a full motion six DOF simulator like the CMS, is unproven in the field. Although it is supposed to provide superb fidelity of most cockpit tasks, the most troubling aspect is that only "selected emergency procedures" can be trained using the device compared to the full motion CMS in operation today.[17] This is cause for concern in the less experienced, highly turbulent pilot population in the Army today. In other words, the best attack helicopter force in the world for the best army in the world does not have a simulation device to train its pilots and aircrews. To offset missing or non-concurrent simulators, more time in the actual cockpit at increased cost and training risk is required, particularly for the Apache Longbow (AH-64D) units. The Army Aviation Center estimated that an additional "3.0 flight hours per aircraft per month OPTEMPO to offset lack of simulator" is required to reduce risk in a Longbow Apache unit.[18] For a battalion of 24 aircraft, that equals 864 additional flight hours at a cost of $3.1 million (AH-64A = $3,561 per hour) more dollars per year; dollars and risk that the army cannot afford. The longer the LCT is delayed the more training dollars will be spent to make up for the lack of a simulator. Simultaneously, risk will increase because pilots will not have the opportunity of performing emergency procedure training a flight simulator.

Now the Army has outdated AH-64A CMSs and no trainer for the Longbow. Hindsight is nearly always 20/20. But, a workable simulation strategy should have provided a better range of options. Unfortunately, because of a lack of upgrades, AH-64 commanders have few simulator training options in their units. Since the fielding plan for LCT spans several years, it would have been possible to upgrade selected CMSs for those units receiving AH-64D's last in the modernization cycle. That would stem the negative habit transfer, reduce training costs, provide an opportunity for a return on the investment upgrade, and enhance the training value of a concurrently configured, more capable simulator. RC units would benefit from that approach because all current indications suggest that, for the moment, they will be retaining their AH-64As.

The utility and cargo helicopter fleets will also receive funding for airframe modernization; the CH-47D will be upgraded to the "F" Model and the UH-60 will be upgraded to the L Model plus. Simulation and simulators for the UH-60 and CH-47, however, are also not mentioned in the budget as part of the modernization effort.

Although The Association of the United States Army (AUSA) Budget 2000 report says that the "Army is increasing the use of simulators and simulations to expand training opportunities," I could not determine from the construct of AUSA budget report if indeed, the Army provided funding for simulator upgrades.[19] According to a report by the National Training Systems Association (NTSA),

> "In the general R&D budget, most training and simulation technology was funded without comment. However, the Army requested no funds for aviation training devices and the HASC [House Armed Services Committee] recommended $9.3M for improved flight simulators which included geographic-specific databases."[20]

Since the $9.3 million is the congressionally mandated funding mentioned earlier to upgrade the UH-60 and CH-47 flight simulators in Korea, there is an apparent conflict in what AUSA is noting as a stated Army priority efforts and what is actually being funded. That is probably why I could not find any indication there was funding for legacy simulator upgrades.

A program obviously cannot be a priority if it is not funded. Therefore, if the Army is increasing use of simulators and simulation as AUSA states in its report, it is not apparent how much funding is being programmed for that purpose. Given the current interest of Congress to fund device upgrades as suggested by the $9.3 million for simulator upgrades in Korea without the request of the Headquarters, Department of the Army (HQDA), the timing is right for the Army to capture momentum for additional congressional support to systematically upgrade selected legacy flight simulators worldwide. The Army Aviation Center and STRICOM have attempted to seize the initiative to leverage the upgrade of Korea's simulators to upgrade at least one other site for FORSCOM units at Fort Campbell. The Korean upgrades are being tested at Fort Campbell. The concept is to upgrade the entire flight simulator to function at Fort Campbell, validate that the upgrades work, then dismantle the upgraded components and ship the materials to Korea for final installation in those devices. The Fort Campbell simulators will then be returned to their original configuration. It makes great sense to upgrade the Fort Campbell simulators and leverage the non-recurring development and testing costs as well as saving the funds required to return the Fort Campbell simulators to their original (outdated) form.

This is a great initiative. But, again, it is a fragmented approach by great soldiers trying to fix an Army wide problem. Commanders in the field are working toward that end on their own. The Army should institute an approved strategy for legacy simulator upgrades that will cost less in the long run than the fragmented approach underway today.

WHAT IS THE CURRENT AVIATION SIMULATION/SIMULATOR STRATEGY?

Research into this question has not produced a single overarching strategy. This is probably due in part to the number of agencies involved and unclear divisions of responsibility for different aspects of the simulation program. The Deputy Chief of Staff for Operations (DCSOPS) of the Army has different parts of the simulation program under force development (DAMO-FD) and training (DAMO-TR). Training and Doctrine Command (TRADOC), through the Aviation Center at Fort Rucker, determines the requirements for simulation devices. The Program Executive Officer (PEO) for Aviation, under the Service Acquisition Executive, Under Secretary of the Army for Acquisition, Logistics and Technology, is responsible for procurement of simulation devices and budgeting for simulator upgrades. The Army Material Command (AMC) is the Army's materiel developer. Through STRICOM, AMC is responsible for maintaining the training devices once they are fielded. The number of agencies involved in fielding and managing TADSS is large and suggests at least a partial explanation of why a single coordinated aviation

simulator/simulation strategy is difficult to find and why upgrades to legacy flight simulators have not occurred.

There is no single overarching aviation simulation or simulator strategy that synchronizes the efforts of the Army's material developers, trainers, and procurement specialists. There are really two key strategies; a Training and Doctrine (TRADOC) strategy (Army Aviation Center, Fort Rucker, Alabama), and an acquisition strategy for the procurement of aviation systems and training devices managed by the Program Executive Officer (PEO) for aviation. Neither strategy is written as an 'ends, ways, and means' approach for achieving a trained and ready aviation force. TRADOC is the Army's lead agency for developing requirements, but the final approval and funding is normally provided by the Army's Operations Officer; the Deputy Chief of Staff for Operations (DCSOPS). The aviation PEO is given budget authority to procure aviation systems and training devices and the Army Material Command (AMC) sustains them. Each organization has priorities of its own but each is driven by Army requirements. For a system upgrade requirement to become a reality, the agency given responsibility for funding it normally decides the fate of a program based upon priorities and funds available. That is at least a partial explanation why the program managers for fielded systems, who have the responsibility for training device upgrades, did not push for upgrades to training devices such as the flight simulators. Too little funding was available. But, changing mindsets and applicable regulations that govern modernization programs for aircraft, should, in the future, ensure that aircraft modernization requires training devices to be included in the funding and fielding process for aircraft upgrades. Failing to do so will perpetuate the problem and continue to prove that equipment modernization by itself, without improving the training tools, does not ensure a ready force.

<u>REQUIREMENTS DETERMINATION</u>

In the Army's Requirements Determination Pamphlet (March 1996), Training and Doctrine Command (TRADOC) is charged with the responsibility "for generating the bulk of the concepts and requirements" for the Army.[21] Inasmuch as the document designated TRADOC as the Army's requirements developer, it also suggested that TRADOC was being bypassed in the requirements determination process. It specifically noted users of Training Aids, Devices, Simulators and Simulations (TADSS) as being violators of the TRADOC controlled process. Given the out of cycle congressionally mandated budget approval for the Eight Army's (EUSA) UH-60 and CH-47 flight simulators, without an apparent request for funds by the Department of the Army, TRADOC's assertion appears accurate.

> "Because of the hectic pace of change and limited resources, the process for determining requirements can be neither as linear as it once was nor can it afford to become undisciplined. In the attempt to keep pace with the current rapidity of change, the process of determining requirements has become fractious. As but one of several examples, non-system training aids, devices, simulations and simulators (TADSS) are generated outside of TRADOC and passed directly to DA without TRADOC knowledge. Likewise, materiel capabilities are being developed through the technology base without

a defined requirement. No one wishes to throttle creativity or ingenuity; however, both integration and discipline must be achieved to move into the future with efficiency."[22]

In its effort to control TADSS upgrades, TRADOC is highlighting what may potentially be another larger issue; the Army's responsiveness to the needs of its field commanders. With respect to the senior commanders requesting upgrades to their legacy flight simulators in Korea and Europe, either the current requirements determination system is so bureaucratic that frustrated soldiers are bypassing established channels, or the priorities of the institutional Army are out of synch with commanders in the field.

The Army, as an institution, wants to obtain efficiencies that make sense. But, as the institutional Army 'moves into the future with efficiency' it must recognize that efficiency is a process to be worked and a goal that does not by it self, equate to an endstate. An effective Army is and should remain the endstate to be reached with efficiencies gained in the processes the Army uses to achieve those ends. If efficiencies are possible while providing for an effective Army, fine. The problem is, the Army, and in particular, Army aviation has been too efficient in terms of doing more with less for too long; the euphemism that has permeated the Army and the Department of Defense for nearly the last decade. The Army and the entire DOD has been very efficient at using limited RDA dollars to fund short-term readiness as noted in the AUSA 2000 Budget Report. In the process, however, years of continued exposure to the efficiency mantra has caused efficiency itself to appear more like endstate rather than the process it should be.

As a result of efficiencies to be explained later, we now have an Army Aviation branch that is very capable but is less effective and less safe, in my opinion, than it was 5 years ago. Fewer flight hours over several years, less modernization of equipment and training devices along with a changed pilot population and the restructure of aviation units all contributed. These reasons and more are probably why three of Army's most senior aviators suggested in the Army Times that Army aviation is branch in crisis and why frustrated Commander's in Korea and USAREUR are requesting directly from DA, funding to upgrade flight simulators within their area of operations. When considering requirements determination, I believe the Army would rather see a bit more inefficiency that assures we move into the future with effectiveness rather than the other way around.

TRADOC: A NEW WAY OF DOING BUSINESS?

The Army is often accused of preparing to fight the last war. As a consequence, the Army is very introspective as to the focus and direction of future warfighting. In its TRADOC Requirements Determination Pamphlet (TRDP), the Army describes a new way of doing business. On one hand, it is an enlightened approach that answers the concerns of Congress and the Army's critics. On the other, it may focus too much on processes that anticipate future requirements than on individual soldier preparation as the basis for unit and higher-level organizational readiness. The TRDP notes that:

"The Army constantly upgrades and changes the way it fights in order to maintain battlefield superiority over all potential adversaries and to achieve complimentary

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capabilities with other services and nations. . . .For the past three years, the Army has explored new ways to determine requirements. We now determine requirements more holistically based on desired Joint and Army **capabilities** versus known deficiencies. We are not trying to perfect yesterday's shortfalls; rather, we are anticipating tomorrow's required capabilities. This is being driven by warfighting concepts focused on the future and experimentation in our battle labs to discern viable requirements." [23]

Ultimately, whatever the strategy or methodology adopted, the Army's requirements determination process must not forget that **a trained soldier** is the key to its success and that the strategies for training, materiel acquisition and sustainment must all support the soldier's ability to perform peacetime and wartime tasks. For Army aviation, it's the individual pilot and individual aircrew that must be the priority for training consistent with a 'holistic approach' to future training requirements that is the current buzzword of the day. Therefore, investments in flight hours and simulation and simulators that enhance a pilot's ability to employ a helicopter as an extension of himself will be money well spent toward achieving improved readiness. Unfortunately, contrary to the holistic approach being espoused, some of yesterday's shortfalls must be perfected in order to provide tomorrow's capabilities. Future requirements must maintain a pilot and aircrew focus as the Army continues to develop better means of training in the joint arena. The upgrade of legacy flight simulators is an urgent Army requirement to reverse the negative trend of aviation readiness and accidents and provide enhanced capability for tomorrow. In short, modernization of aircraft alone will not assure a trained and ready aviation force. Investment in training and training devices must support equipment modernization programs.

WHY ARE UPGRADES IMPORTANT NOW AND WHY FOCUS AT THE PILOT LEVEL?

History shows that armies focusing training resources at the lowest level, the soldier, are well prepared to do their nation's business. Despite great success of what we now know as Blitzkrieg Warfare, following the successful invasion of Poland in 1939, the German Army conducted extensive analysis to better prepare for future operations. Not surprisingly, the focus of the German Army was on training the soldier before success could be achieved in collective level units and events:

> The training programs within the German divisions aimed at first building up the capabilities of the individual soldier and then establishing the capabilities of the platoons and companies. Once small-unit training had reached satisfactory levels, then larger scale battalion and regimental exercises could be conducted." In addition, the "Germans obviously felt that realism in training was of inestimable importance, and one training officer suggested that exercises that did not give a realistic impression of the enemy and of combat conditions were useless."[24]

The U.S. Army and Army aviation in general would do well to follow the German Army's example by preparing its pilots for success in future combat for much less dubious but no less important reasons. Our current strategies place too little emphasis on pilot skill development and sustainment. Consequently, the urgency of need to focus at the pilot level now is not only to better prepare aviation

soldiers for fighting our nation's wars but, to reverse the steady erosion of pilot experience that contributes directly to Army aviation's current readiness problem.

In the late 1970s and early 1980s, the average instructor pilot had between 3,500 and 6,000 flight hours in less complex aircraft (UH-1, AH-1, OH-58) that flew predominantly day missions.[25] Today however, the average instructor pilot has between 2,000 and 2,500 flight hours and flies between 25% and 40% of his time at night often in a nap-of-the-earth mode of flight; the most demanding flight mode with the highest risk. During that same period, the accident rate for major aviation mishaps went from a rate of just over 18 per 100,000 flight hours to just over 2 per 100,000 flight hours by 1987, despite the transition to more complex aircraft and a more demanding but 'normal' flight profile.[26] Proficient aviators, predominantly with Vietnam experience, clearly learned the risk management tools to deal with aircraft mission complexity that changed from the fleet of UH-1s, AH-1s, CH-47(C Model) and OH-58 (A/C Model), to the modernized fleet of today; AH-64s, UH-60s, CH-47Ds, and OH-58Ds. They had the experience to know 'what right looked like.' Since 1987 however, with the precipitous drop in pilot experience, the accident trend has been upward for the Army's worst mishaps (A thru C) from just over two (2) per 100,000 flight hours to about eight (8) per 100,000 flight hours.[27] As a further indicator of this experience drain from the Army, battalion commanders 10 years ago had an average of 2,000 flight hours. Now, they have an average of 1,000 hours at the time they take command and the tomorrow's battalion commanders are projected to have just 700 hours of flight experience before taking the guidon.[28] As noted in the functional area assessment for Army Aviation completed in 1998, "It is difficult to lead when you don't know what right looks like."[29] To develop those skills, it takes more time in the cockpit. It is not surprising then that the top five aviation hazards noted in the FY99, Army Safety Center Report further point to the erosion of pilot experience:

"Priority 1, Leaders may selectively enforce standards (published standard is not the same as the accepted standard)

Priority 2, Maneuvering among obstacles in a degraded visual environment may cause an escalation in workload, increasing fatigue and diminished capacity to safely maintain aircraft position, resulting in collision with the ground or obstacles.

Priority 3, Hovering in close proximity to terrain in a degraded visual environment and high workload may result in loss of situational awareness, resulting in inadvertent hover drift and collision with terrain.

Priority 4, Multi-ship operations in close proximity under high workload conditions may result in loss of situational awareness and multi-aircraft collision.

Priority 5, Leader or unit may lack experience or seasoned leadership to manage risks associated with that unit."[30]

It could be argued that all five (5) safety hazard priorities noted above have a basis in a lack of flight experience by individual pilots. The selective enforcement hazard, although discipline related, is

probably more indicative of not knowing what the standard is rather than a lack of discipline enforcement. In addition, Priority 2, 3 and 4 above have strong linkages with the negative habit transfer that occurs today between the actual cockpit and flight simulators when workload is high. More flight experience, time in the cockpit - to learn what right looks like for an Army Aviator, will help not only leadership aspects of aviation readiness, but it will reduce inexperience among the Army's pilot population and thereby reduce susceptibility to the top five hazards to flight safety. But, while flight simulators can greatly enhance flight-training programs across the Army and are an essential element of a training and acquisition strategy aimed at rebuilding the experience base of the Army's pilot population, it is critical that the legacy systems be upgraded first. Achieving a balance of live and simulator training, upgraded flight simulators will help reduce operational risks, reverse the accident trend and greatly enhance training at reduced cost.

A LONG TERM CAUSE TO THE CURRENT READINESS PROBLEM

Since 1991, the funding of the flight hour program (FHP) has slowly decreased until fiscal year 2000 (FY00) in which a slight increase in total FHP funding occurred. Today, not only has the departure of Vietnam era aviators reduced the experience base in Army aviation's ranks, cuts in training programs failed to adequately train those pilots who remained.

The flight hour program contributes directly to the readiness of aviation units. It provides the opportunity for individual and collective training. Given the complexity of helicopter flight, training is progressive. There must be a high level of individual skill in the cockpit before collective training can occur. Retention and turbulence factors too, although beyond the scope of this paper, are nonetheless important considerations affecting the Army's ability to train an aviation force. These factors should shape the programs required to counter the loss of experienced pilots. Suffice it to say that if the Army is constantly required to replace those leaving with new pilots, a significant part of the training effort should focus at the pilot and aircrew level.

The reduction in flight hours over the last decade and its negative impact in individual and collective pilot readiness occurred for two primary reasons: Cuts in defense spending spread exacerbated by OPTEMPO costs paid for by training dollars coupled with the implementation of the Aviation Restructure Initiative (ARI). It is common knowledge that flight hour programs were cut but the readiness impact of ARI across the Army is less well known.

ARI was fully implemented in 1995. In concert with flight hour reductions, ARI made a bad situation very much worse. ARI was focused on gaining fiscal efficiency through economies of scale by building aviation units with a single aircraft type, common military operational specialties (MOS) and mission focus, and a common maintenance system. The AH-64 Attack Helicopter Battalion was affected most by the ARI structure that substantially changed to the pilot-to-seat ratio.[31] For example, the Army of Excellence (AOE) attack helicopter structure had 34 aircraft (3 UH-60s, 13 OH-58Cs, and 18 AH-64s) with 72 pilots assigned. Under ARI, the attack helicopter units changed to a pure fleet of twenty-four (24)

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AH-64s with sixty-four (64) assigned pilots; a reduction of ten (10) aircraft and eight (8) pilots. Assuming full strength units, the ratio of pilots to airframes that had four (4) assigned pilots without seats in the AOE structure had grown to sixteen (16) pilots without seats under ARI. At the aviation brigade level, ARI changed the pilot to seat ratio changed from 1:1 to 1.5:1.[32] While ARI achieved cost efficiencies, another more insidious affect was that fewer flight hours per pilot were being flown, particularly in the Attack Helicopter Battalions which some believe have the most complex aircraft to fly and mission to perform. In other words, more pilots flying fewer aircraft increased the pilot-to-seat ratio that provided fewer training opportunities for all pilots assigned to a unit.

More pilots flying fewer aircraft in the ARI force structure would not in itself have been a problem. However, it became a significant part of the readiness problem because the Army funded its flight hour program (FHP) as it always had - by airframe instead of by pilot. Flight hour sourcing per aircraft in an ARI unit of 14.5 hours per month translated into less than 11 hours of flight training per aircrew per month for the active component units. The number of hours available to train was not only reduced per cockpit because of general defense cuts, the simultaneous move to ARI exacerbated the problem by spreading fewer hours per cockpit over more pilots to train. Consequently, aviators were barely maintaining currency requirements (minimum flight hour standards required by regulation) and not achieving high level of proficiency. The amount of flight training pilots received in flight school had also been reduced. The combined effect of reduced FHP, less training hours in flight school, and ARI inadvertently put great pressure on field units. These units lacked the resources to compensate for those impacts as well as the experience of those aviation soldiers leaving the service.

Since the 1970's, despite the increased complexity of aircraft and mission profiles, students graduating from flight school get 15% fewer hours in a live aircraft during the initial entry flight training.[33] Although students attend follow-on training in advanced aircraft (AH-64, UH-60, CH-47, and OH-58D), the overall trend has been to compress training to save dollars because the newer systems, although much more capable compared to their predecessors, are also much more costly to operate. Factoring in reduced flight hours new students were receiving at flight school, commanders in the field have had and will continue to have a serious training issue: an inexperienced pilot base that requires more training hours out of flight school just to get to an acceptable level of individual readiness before collective training at the unit level can be accomplished. To compensate, I have been told that some field units resorted to building training platoons for aviators out of flight school to accomplish the task of enhancing individual pilot skill before assigning pilots to units. These methods, while effective, treat the symptom rather than the problem and consume valuable flight hours that should be used for mission training. The Army, in its attempt to 'move into the future with efficiency', had accepted incalculable risk by reducing training opportunities to reduce costs. In accepting increased risk, it was possible and even foreseeable that accident rates could climb and Army Aviation become less ready. In hindsight, a fourfold increase in the accident rate and the readiness issues embodied in Task Force Hawk's deployment to Albania, the possible became a reality.

In FY2000, the Army changed the policy to fund flying hours per crew instead of per aircraft and is funding an average of 14.5 hours per crew per month.[34] But, the damage has already been done the last several years. A one year of increase in flight hour program (FHP) funding, although a step in the right direction, will not counteract a readiness problem years in the making. Apache units are supposed to get a higher percentage of the total. "Funding for AC (Active Component) combat units provides an above-average crew OPTEMPO for attack helicopters (15.0 hours), while taking risk in utility helicopters (14.4 hours) and heavy lift helicopters (13.0 hours).[35] By skimming flight hours from utility and cargo the Army is accepting more risk. Utility (UH-60) and Cargo (CH-47) units may have less complex aircraft compared to the AH-64, but these same units often perform the more difficult missions of moving troops and external loads (slings) while training for combat. These same aircraft are often utilized in support of civilian agencies or in disaster relief operations around the world. The pilots of these aircraft have the requirement of flying in bad or marginal weather conditions, something the Apache, a fair weather platform, was not designed to do. Therefore, involving the lives of more than just the crewmembers increases the stakes involved. Too often, those facts are forgotten when decisions are made to adjust hours from utility and cargo helicopter units to Apache units. Moving the risk from one type of unit to another is not the type of management approach needed to provide the across-the-board readiness boost the Army needs in its aviation forces.

Increasing the FHP must be broad-based to all aviation units regardless of airframe type. The aviation readiness problem must be solved with a long term commitment of increased training in the schoolhouse, sustained increases in FHP funding for all field units, upgrades to legacy light simulators, and continued development and fielding of Army Aviation's combined arms training strategy (CATS). Leveraging live training with virtual and constructive simulation is critical to the Army's success in this effort.

Other services have faired better in terms of overall flight hour funding per aircrew according to recent budget figures for FY97 through FY99 (See Table 1 below). Given the Army's involvement in most U.S. deployments since the end of the cold war, the decline in readiness and experience and the importance of aviation to the Army's mission, an argument should be made to increase the funding of the

DOD FLYING HOUR RESOURCING[36]

	FY 97	FY 98	FY 99
NAVY			
Tactical Hrs Crew/mo	21.1	22.6	23
USAF			
Fighters Crew/mo	19.3	18.7	19.1
Bombers Crew/mo	19.9	19.3	17.9

TABLE 1

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FHP in the Department of Defense (DoD).

> "Since 1989 the Army has provided over 60 percent of the forces for 32 of 36 major deployments while at the same time its force structure was reduced by 33 percent, its infrastructure shrunk by 21 percent, and its obligating authority decreased by 37 percent."[37]

Although more live flight training is desired, an alternative to expending additional flight hours, is to provide more training in flight simulators, but only if they are upgraded to accurately replicate the actual cockpit and provide enhanced realism.

TRAINING STRATEGY

The current training strategy outlined by the Army Aviation Center at Fort Rucker strives to provide a combination of virtual, live and constructive training in a multi-echelon approach that trains individual pilots, small unit leaders and staffs, up to and including battalion and brigade commanders. That overall approach is in synch with TRADOC's Requirements Determination Pamphlet (March 1996) as well as with Army, DOD, and Congressional interests. Some of the training systems will be able to join with other Army branches in support of TRADOC's Combined Arms Training Strategy (CATS) that will network with joint or other combined arms team members in a Synthetic Theater of War (STOW). Construction of the Aviation Warfighting Simulation Center (AWSC) due to open in 2002, will leverage this capability in a structured environment resourced to provide state of the art virtual and constructive training primarily at the collective level. Although the AWSC has great merit and moves aviation training a quantum leap forward into the 21st century. But with all its potential, it does not improve proficiency at the hard skills needed most now; in the cockpit at the pilot and aircrew level. The Longbow Crew Trainer (LCT) for the Longbow Apache intended to replace the outdated Apache CMS, is an exception as it is both a pilot and crew trainer. Still, the LCT program has significant problems. Not only will the LCT be one year behind if initial delivery occurs in September 1999, the LTC also represents unproven technology to train all tasks, particularly the emergency procedures, that the high fidelity, full motion Apache CMS currently trains.

Although the Army Aviation Center at Fort Rucker noted serious deficiencies with legacy simulators during the 1998 Functional Area Assessment (FAA), the Army has not provided funding for STRICOM's proposed plan to correct them. The current simulation training strategy is focused primarily on fielding a collective training device called the Aviation Combined Arms Tactical Trainer (AVCATT). Begun years ago to link virtual devices across the many Army branches and battlefield operating systems in the digital force, Army aviation's collective trainer is:

> "a dynamic, alternative instructional concept to rehearse and participate, through networked simulation, in unit collective and combined arms simulated battlefield environment. AVCATT is a critical element of the Combined Arms Training Strategy (CATS) and support institutional, organizational, and sustainment training for both Active Component (AC) (AH64A, AH 64D Longbow Apache, RAH 66 Comanche, OH 58D

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Kiowa Warrior, UH 60A/L/K/Q Blackhawk, and CH 47D Chinook aircraft), and reserve Component (RC) (AH 1F/P cobra, and UH 1H/V Iroquois) aviation units worldwide. Simulated collective and combined arms exercises will provide commanders with an affordable capability to hone and sustain individual performance levels to support unit collective training and rehearsals, and combined arms wartime mission performance requirements. AVCATT will be Distributive Interactive Simulation (DIS) compliant, compatible, and interoperable with other Combined Arms Tactical Trainers (CATT) (i.e. Close Combat Tactical Trainer (CCTT), Engineer CATT (ENCATT), Air Defense CATT (ADCATT), and Fire Support CATT (FSCATT). AVCATT will provide a realistic, high intensity, task loaded combat environment, composed of attack, reconnaissance, and lift aircraft platforms, Semi-Automated Forces (SAF) work stations, Aviation Mission Planning System (AMPS), After Action Review (AAR) capability, and battalion/squadron level staff work stations."[38]

The construction of the AWSC will provide a venue for the AVCATT to function as part of Aviation Training Exercises (ATX) conducted in an environment conducive to maximizing the potential of virtual, constructive and live simultaneous training. But, compared to legacy systems, AVCATT is a lower fidelity trainer oriented at the platoon level of training and higher. It will provide a tremendous training benefit to platoon leaders and company commanders learning how to lead and fight their units. It will not, however, provide the visual and motion cues to train emergency procedures and other tasks that the high fidelity, legacy simulator systems currently train. As noted earlier, individual proficiency must be established before proceeding to higher skills required to successfully employ aviation platoons and companies. Therefore, while the current training strategy combines live, virtual and constructive simulation more effectively than ever before, there is insufficient simulation and live training of 'in the cockpit' pilot and crewmember skills because the primary trainers, the legacy simulators, are outdated. LTG Riggs, one of the Army's most senior aviators, noted recently in the Army Times that "several actions . . .must be taken soon to correct the Aviation branch's systemic problems" to include improving "aircrew member and unit training . . ,from flight school through combat" and also to "Build leaders who understand and appreciate combat . . ."[39]

The AVCATT and other virtual systems will provide Army aviation soldiers tremendous leader and small unit synchronization training. But, AVCATT is, again, only one element of the solution noted by General Riggs. There also needs to be more aircrew training in flight school and in units. With flight hour costs rising, aviation can always expect to be subject to cuts in flight hour funding. Re-capitalizing our legacy simulators by modernizing them at a fraction of the cost of fielding new systems will provide training opportunities in times of budget distress that should be a relevant part of the Army's aviation training strategy for years to come. To ensure success, any training strategy must be supported by a flexible acquisition strategy that keeps critical training device upgrades integrated with aircraft modernization programs.

ACQUISITION STRATEGY

The Army Development, Acquisition and Fielding Strategy (ADAFS) 1999, noted that

"The army is moving away from the stove pipe model of developing and acquiring systems in favor of a system-of-systems approach to development, acquisition and fielding. The system-of-systems approach recognizes that every platform, weapon system, computer, radio, piece of equipment, and even every soldier is not only a unique entity, but also a part of the greater system. The systems approach emphasizes seamless integration, cooperative development, and commonality of components wherever possible. . . . The Army recognizes that good ideas can and do come from anywhere and at any time. Therefore, experimentation and a spiral process - both **focused on the soldier** - together allow for ideas to be considered along the path to Army After Next (AAN) in a nonlinear manner."[40]

The stated intent of the ADAFS, highlight above, is to focus on the soldier. A closer look at the strategy, however, may indicate a different focus. The ADAFS outlines a modernization strategy that takes into account emerging technologies as the Army prepares to field equipment for the future. While heralding a revolution in military and business affairs, the ADAFS appears more focused on equipping future soldiers with modern warfighting technology than on ensuring they are trained. While fielding modern equipment is critically important, training is equally important but seems to get less emphasis.

TRADOC is responsible for training, but equipment modernization requires a procurement focus on fielding or upgrading the other equipment essential to ensure that soldiers today and tomorrow are trained to perform their missions. Although the discussion of Modernization Framework, Modernization Strategy, and Modernization Principles in the ADAFS spans eight pages, the strategy said surprisingly little about modernizing training equipment let alone the upgrade of key training devices. This suggests a lack of senior leader focus that balances procurement priorities between training and warfighting equipment. Focusing on future technology to equip soldiers is of course, essential. But, training soldiers is of even greater importance now and in the future. The lack of training emphasis in the budget, the aviation training strategy, and the acquisition strategy, indicates that the Army is missing a key point – soldier skills, particularly for pilots, is the fundamental element in the larger context of Army readiness. A lack of emphasis on the tools that further fundamental soldier skills is underscored in Army aviation procurement strategy, a subset of the ADAFS.

The Army aviation acquisition strategy is a document written by the PEO Aviation Office, Redstone Arsenal called <u>Army Aviation Training Aids, Devices, Simulator and Simulation Acquisition Strategy</u> (AATAS). The AATAS as it currently exists, is a large document that seems more a compilation of individual simulation devices/training aids than a comprehensive strategy that puts a mark on the wall for aviation oriented procurement. The AATAS contains a great deal of useful information. But, the language and terminology used in one particular area at the beginning of the document suggest no one is really in charge to ensure training devices are upgraded. For example:

> The AATAS document published in March, 1999 states that "Concurrency of training devices typically lag the upgrades to the fielded aircraft. When major block upgrades are incorporated into aircraft training devices, this corrects most of the deficiencies. But changes below this level are generally slow to be incorporated into the trainers, either due to insufficient resources, finalization of formal upgrade requirements documentation, confusion in who is responsible for funding/executing the upgrade, or a combination of all the above."[41]

Without clear lines of responsibility identified in the acquisition strategy, it is understandable, but not acceptable that training devices like the legacy flight simulators, are outdated and lack the essential upgrades for concurrent configurations with aircraft cockpits. If there is confusion as to which agency is responsible for 'funding/executing the upgrade', as the AATAS indicates, then current regulations lack the clarity to ensure the right agency takes action to keep training devices upgraded. The language in the AATAS and 10 years without upgrades that keep simulators concurrent with the aircraft demonstrate there is great confusion. This is probably one reason why the senior commanders in Korea and Europe requested upgrades of flight simulators in their respective areas of responsibility.

Complex aircraft and aviation missions demand training devices and methods that are first rate and keep pace with configuration and capabilities changes in fielded aircraft. But, no systems or regulations have been identified that mandate critical training devices be upgraded to match changes due to aircraft modernization. TRADOC's requirements determination process has not corrected the situation. As a consequence, flight simulators as well as other training aids and devices are outdated and providing less training value than is otherwise possible. Although there are other factors involved in this issue and it is overly simplistic to suggest that the language of the AATAS indicates a failed strategy, it nonetheless demonstrates that critical training devices like flight simulators are not considered important enough in the budget to keep pace with fielded aircraft. The fact that most flight simulators have gone without funded upgrades for nearly ten years and operate on fifteen-year-old computing technology proves that point.

The current process of funding and fielding aircraft upgrades does not link training device upgrades to the modernization process. Not all aircraft upgrades should necessarily require a change to the simulator. But, the process should include considerations of simulators whenever aircraft are upgraded and therefore, it must be changed to fully integrate the Army's training devices into the effort. It is critically important to realize that necessity because the Army is in constant change. For example, even if it is shown that devices like the LCT or AVCATT should supplant the legacy systems that should have been upgraded years ago, modernization of fielded aircraft will inevitably continue in the future. When it does, aircraft modernization programs must trigger corresponding upgrades to aviation training devices in order to maintain their relevance and provide concurrency of configuration for safety and training realism. This concept is applicable to all branches of the Army.

ARE FULL MOTION SIMULATORS REQUIRED FOR EFFECTIVE TRAINING?

The FAA has commissioned numerous studies to determine if simulator motion is required to provide effective training that better translates into the live cockpit. A recent study, although inconclusive, strongly suggests that the best training medium has a combination of visual and motion cues. The current direction of Army aviation flight simulation is away from motion based systems now in the field. The requirement for motion adds significant cost to a flight simulator in addition to making it non-deployable; a negative characteristic in today's force projection Army. But whether the combination of

visual and motion cues can be adequately replaced by visual cues alone from high-speed advanced image generators is unknown at present. If the numerous FAA studies are inconclusive, perhaps the Army is either wrong or premature in its present course of action: pursuing non-motion, deployable flight simulators of lower fidelity while excluding legacy flight simulators from critical upgrades.

The FAA's purpose in answering the question of motion versus non-motion or rather, how much motion is good enough, is much like the Army's; to field devices that provide realistic training at acceptable cost. In one of the more recent FAA studies, an "international panel of experts felt that motion may have an important alerting function in maneuvers entailing sudden motion-onset cueing, such as loss of an engine during initial segment climb, where visual references are limited."[42] According to the FAA study, the tasks involving pilot reactions to an aircraft movement are called disturbance tasks. In Army aviation, due to the nature of helicopter flight and the mission profiles flown, there would be a great many 'disturbance tasks' to be trained. Many of them would most likely involve emergency procedures and also 'reacting to contact' in a combat situation. What the FAA found is that disturbance tasks are best trained in simulator that uses combined visual and motion cues.

> "When investigating the role of motion cues when controlling an airplane, it is important to differentiate between two tasks, tracking tasks and disturbance tasks. In a tracking task, the crew is asked to track a random signal, such as a specific flight path or the lead airplane in formation flight. In this sort of task, the signal only affects the central vision cues and not the peripheral or the motion cues. Motion cues become relevant only after the pilot's response to the signal, by giving feedback on the pilot's control actions. In a disturbance task, the crew needs to correct for a random perturbation of the controlled system such as stabilizing the airplane in turbulence or compensating for a mechanical failure (e.g., an engine failure). In this case the random signal affects the entire controlled system (i.e., the motion system as well as the visual systems and instruments). Thus, platform motion provides an early alerting cue to the disturbance that could potentially enable a more rapid response with motion than without motion. Given these differences in the role of motion for the two kinds of tasks, it is important to examine the role of platform motion individually for each. For tracking tasks, Hall (1978) and Hosman & van der Vaart (1981; Hosman, 1996) found only a small effect of motion on performance . . . .In contrast, there was a large effect of motion with disturbance tasks. . . . In addition, Hall (1978) and Hosman & van der Vaart (1981) each examined the interaction between vision and motion cues. For both kinds of task they found that the effect of motion was strongest when there was no visual information available. That is, visual information could compensate for the lack of motion to a certain extent. Even so, **vision alone**, even with peripheral vision included, **was not as good as vision and motion together**."[43]

I was also curious to know if simulator training was mandatory by the FAA and why. I made several email queries before contacting Dr. Cook of the National Simulator Program; a subordinate organization of the FAA. When I asked him if full motion simulator training is mandated for pilots, and if yes, why? Some excerpts of his email response are noted below. I have highlighted specific comments relevant to my argument.

> "For complete training and checking, the FAA requires full motion . . . . The simulators are classified into 4 levels. . . . The reasoning behind this multi-level approach has to do with the relative level for cueing afforded the pilots. A significant element is that not all pilots

necessarily use the same set of cues for the same task, and its probable that they do not use the same individual cues within any set of cues to the same extent for any given task. When the set of cues is limited, for any reason, including simulation, the pilot (knowing that humans are quite adaptable) will likely use a substitution of perhaps less acceptable but more available cues to accomplish the task. Pilot instructors have known for years that different students respond to different "techniques" and "different sets of instruction" as they learn to fly. We believe that at least some of these differences can be accounted for in the set of "cues" the instructors use that may be similar yet slightly different from the set of cues the student can grasp and use. If the student has available the cues he/she is most familiar with in his/her flying career, the learning experience will be easier, longer lasting, and most directly applicable when it comes time to perform in the airplane. As we have come to believe, if we expect pilots to fly the way they are trained and checked – **we must train and check them in an environment that is essentially equal to that in which they are expected to fly** – and the cues provided and used are critical in this effort."[44]

Clearly, in the opinion of the FAA, full motion simulators, with concurrent cockpit configurations, can provide the 'environment that is essentially equal' to the live aircraft to replicate the cues a pilot would normally receive in fight.

The FAA recognizes that motion-based simulator platforms are fundamentally important to the quality of the flight experience that transfers training knowledge from a simulated to a live cockpit. Likewise, the Army may be ill advised to fund only the newer, non-motion based technologies. Exempting legacy systems from an overall aviation simulation and training strategy the Army is accepting a great, and perhaps, unacceptable level of risk. Until it is shown that new technology for LCT and AVCATT, devices without motion, provide the same level of cueing and training quality in all tasks, particularly emergency procedures, that a full motion simulator can provide, upgrades to legacy systems must be accomplished.

WHAT SHOULD A SIMULATOR/SIMULATION STRATEGY ADDRESS?

A training and simulation strategy that combines the upgrade of legacy systems with the plan to field deployable simulators will provide optimum flexibility for aviation units to conduct essential training and mission rehearsals in simulator. To the extent possible, an aviation simulation strategy should provide simulators and simulation devices that conduct multi-echelon training with emphasis on pilot skills in a combination of networkable, fixed base facilities (full motion legacy systems) and networkable, portable devices. That combination will leverage the potential of existing systems while providing for means to conduct mission rehearsal and simulator training for a deployed force.

The current training and acquisition strategies, while visionary in many ways and in synch with DOD and the Army's broader objectives for Force XXI and Army After Next (AAN), do not solve the immediate problem of reduced pilot and aircrew readiness. No amount of staff or collective training inherent in the current strategy to field AVCATT and LCT will prepare tomorrow's pilots to effectively assume the mantle of leadership without them first mastering and demonstrating flight skills in the cockpit to learn 'what right looks like' in the cockpit and out. As a pilot becomes comfortable with the workload

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and division of attention to plan, fly, navigate, and communicate simultaneously, the aircraft becomes more an extension of a pilot than a piece of equipment being operated. This type of development is absolutely critical for rearing pilots-in-command (PIC); a pilot with the demonstrated leadership and flight skills to be in charge of an aircraft and its crew during the course of a mission. It is the highest level of skill development and experience a pilot can achieve and it normally occurs between 300 and 500 hours of flight experience. It is the PIC experience Army aviation needs to build into its future aviation leaders. Therefore, a central focus of an aviation training and acquisition strategy must be the development and retention of pilot skills that produce PICs as a precursor to assuming future leadership positions at any level.

A pilot's skill set develops individually and collectively from hours and years of training. Ultimately, the aircraft becomes an extension of the pilots and crewmembers that operate them. Pilots must be so familiar with an aircraft's capabilities that its operation becomes second nature to them before he or she employs it as a weapons platform in a combined arms team. The Commander's Guide for Army aviation, Training Circular 1-210, states that

> "The Mission Essential Task List (METL) identifies collective training and defines the unit as a member of the combined arms team. To ensure absolute efficiency of Army Aviation in the combined arms effort, crews must function as a unit. **Individual proficiency in the tasks that are required to operate the aircraft also is essential to the training effort."** [45]

Effective collective training in a live situation can only be accomplished the groundwork has been laid in the pilot skills to effectively operate an aircraft. Only then can units progress to the higher platoon and company level collective tasks.

The core competencies that lead to readiness of an aviation force begin with pilot proficiency in operating his/her aircraft. Concurrent collective training at the section, platoon and company level is also essential. Therefore, while the endstate of a simulation strategy is a trained and ready aviation force in a cost effective manner, to do so requires a focus on systems that train and reinforce pilot 'in the cockpit' tasks at all levels, from the individual to collective level company and battalion training. Simulators provide the most cost effective training environment for inexperienced and developing pilots. The live experience in the actual cockpit is enhanced from the preparations simulators provide.

Understanding the 'in the cockpit' tasks in detail from hands on experience will serve leaders well in understanding what mission plans can work and why. Failing to know the intricacies of 'how to' from the pilot's perspective when developing plans and leading soldiers in the execution of the aviation mission will be the source if internal friction, wasted time, and increased risk. The leadership experience is being addressed with virtual and constructive simulations to be reinforced by AVCATT, but the pilot 'in the cockpit' experience is lacking. Additional flight hours are much more costly and will facilitate only some of the additional experience required. Until legacy simulators are upgraded, maximum effectiveness of the training experience will not be achieved. Deployable simulators, such as the LCT, represent gains in operational efficiency at the expense of high fidelity training legacy simulators could provide. As noted

earlier, while efficiency is a process goal, it should not be achieved at the expense of developing and maintaining an effective aviation force. To the extent possible then, the aviation simulation strategy should provide simulators and simulation devices that conduct multi-echelon training with emphasis on pilot skills. A combination of networkable, fixed base facilities (full motion legacy systems) and networkable, portable devices will leverage the potential of existing systems while providing for means to conduct mission rehearsal and simulator training for a deployed force. The fixed base, full motion devices can be upgraded with technology insertion that improves training, allows mission rehearsal, and lowers operating expenses at a relatively low cost.

Legacy simulators will remain relevant for many years to come for some very important reasons: 1 - They can train more tasks overall using motion and visual cues than non-motion simulators; 2 - Proposed upgrades will be cost effective with a return on investment in 5 to 7 years; 3 – If the last 7-10 years are any indication of future deployments, partial versus whole aviation units will deploy in our force projection army. In the example of the AH-64 units, those units with deployable simulators will likely have a training dilemma with only one assigned LCT per battalion. Most deployments in USAREUR between 1997 and 1999 involved partial aviation units. Therefore, a corresponding need exists for both parts of the unit, that which deployed and that which remained behind, to continue its training. A simulator is needed for both the deploying and stay-behind element. If the Army does not upgrade the legacy systems, there will not be a sufficient number of LCTs in AH-64 units to train the unit. The practical, and probably the best solution is a combination of LCT and legacy systems for AH-64 units. The LCT can deploy to train deployed units and the legacy simulators can train the stay-behind elements of the deploying force. A training and simulation strategy that combines the upgrade of legacy systems with the plan to field deployable simulators will provide optimum flexibility for aviation units to conduct essential training and mission rehearsals in simulators. Upgrading legacy flight simulators should therefore, remain an essential part of the aviation training and acquisition strategy.

LEGACY FLIGHT SIMULATOR POTENTIAL – ARE UPGRADES GOOD BUSINESS?

Today, scientific advances are driving vast improvements in simulation technology that can dramatically improve capabilities and reduce operating costs of the Army's premier fleet of flight simulators. Noted earlier, the Army has over $600 million dollars invested in legacy simulators; an investment that should be protected through modernization.[46] Upgrading the Army's fleet of flight simulators with improved computer operating systems and technology insertion (geo-specific data base for mission rehearsal capability) was estimated to cost between $47 Million (STRICOM estimate 96') and $76 Million (Fort Rucker estimate 99') in 1996.[47] Upgrades may cost more today unless the technology insertion planned in 1996 is less expensive because of the proliferation and widespread commercialization of similar computer technology and products.

Estimated upgrade costs in 1996 were between 7% and 13% of the $600 million investment in our fielded high fidelity systems. For the potential increase in training value and the reduction of

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operating costs, investment of such a small cost relative to the investment already made makes great sense. STRICOM's study notes that not only are upgrade costs relatively small, the costs can be recouped in 3-to-6 years solely from a reduction in energy consumption and maintenance costs achieved when the current computer and support systems are replaced. Given the uncertainty of deployable, lower fidelity systems like the LCT in providing an adequate level of cueing for flight training tasks, particularly the emergency procedures, it seems more appropriate to invest not only in AVCATT and LCT, but also in the modernization of the legacy full motion, high fidelity flight simulators. Other considerations legacy simulator upgrades can provide include enhanced training realism, ability to conduct mission rehearsals, and cost effectiveness as flight hours continue to increase in cost.

The Army Aviation Warfighting Center at Fort Rucker runs the Army's flight school that trains soldiers to become pilots. In accordance with Army Regulation 350-38, Fort Rucker leverages simulation and simulators as much as possible to enhance the quality of training while reducing the risks and costs to train pilots. Since the late 1970s, the number of Initial Entry Flight Training (IEFT) hours in the actual aircraft has dropped 15% from 175 to 149 hours.[48] Today IEFT consists of 32 weeks of training (179 flight hours) divided into a common core of primary flight and instrument training (110 flight hours) followed by 12 weeks of combat skills training (69 flight hours).[49] The UH-1 flight simulator, designed for instrument flight training, accounts for approximately 17% (30 flight hours) of the flight training during the 32 weeks of IERT.[50] It is interesting to note that during the instrument training phase of flight school, a 50-hour block of instruction, 60% of the training is completed in the flight simulator.[51] The cost of training in the simulator for a UH-1 is approximately forty-three (43) times less than the actual aircraft. That example suggests that there is significant cost savings potential for the Army by leveraging as much training as possible in high fidelity, concurrent flight simulators.

Following flight school, the new pilots attend aircraft qualification courses that include flight simulator training in one of four Army helicopters: the AH-64A/D, UH-60A/L, CH-47D, and OH-58D. A much higher percentage of flight-simulator to live aircraft training occurs during advanced aircraft qualification than during flight school. Thirty-nine percent (39%) of the 72.5 flight hours (FH) for the Apache are done in the CMS (except the Longbow Apache which has no flight simulator at present). For the UH-60A/L and CH-47D, 37% (13.5 of 36.5 FH) and 28% (12 of 42.5 FH) of the flight training, respectively, is done in flight simulators.[52] But, from earlier discussion, we know that these simulators are non-concurrent and therefore, don't afford the maximum training benefit that is possible. Upgrades to these devices would provide a mission rehearsal capability, improved image generators that would greatly enhance realism and the quality of training experience. Improvements to the legacy simulators to a configuration concurrent with the aircraft coupled with training enhancements would make it viable to increase the percentage of total hours devoted to simulators during the aircraft qualification courses (AQC) being taught today. For example, the Advance Qualification Course (AQC) for the AH-64A, CH47D and UH-60A/L have approximately one-third of the fight training performed in a simulator. Upgraded simulators could to assume more of the flight training that is now not performed due to

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non-concurrency or other reasons (See Table 2 below). Factoring in the potential for increased training time during AQC, the return on investment could be recouped in even less time than the STRICOM study conservatively estimated. Rising world oil prices will have a significant impact on the cost of flight hours as fuel and lubricant costs, rise in the near term. Simulators can provide a hedge against the volatility of selected cost drivers affecting flight hour expenditure.

COST TABLE COMPARING ACTUAL TO SIMULATED HOURS IF SIMULATORS ACCOUNTED FOR 50% OF AQC HOURS DURING AN AVERAGE YEAR

	FLT HR COST	SIM HRS CURRENT	% SIM HR CURRENT	SIM HRS @ 50%	FLT HRS REDUCED	FLT HR COST RE-DUCTION LESS SIM COST
AH-64A 320 STUDENTS	$3,561	28.5	39%	36.25	7.75	$7.2 M
UH-60A 618 STUDENTS	$2,451	13.5	37%	18.25	4.75	$6.4 M
CH-47D 151 STUDENTS	$3,460	12	28%	21.25	9.25	$4.6 M

TOT ANNUAL SAVINGS: $18.2 M

Table 2

In flight school and advanced aircraft training, conducting more simulator training in a concurrent device would better prepare a pilot for the live cockpit, cost less, and reduce risk by providing a better trained pilot without negative habit transfer to maximize the time in the actual cockpit. Leveraging the power of simulation to increase the amount of training flight performed during both initial entry and advanced aircraft qualification could provide significant cost savings, reduced risk and potentially provide more training at less cost.

Once pilots arrive at their units following flight school and advanced aircraft qualification training, they are subject to the Aircrew Training Manual (ATM) for remaining qualified in their aircraft and progressing in experience. The ATM prescribes the minimum hours a pilot must have annually to remain qualified and the training required to advance to pilot-in-command (PIC) qualification. According to the ATM, a certain percentage of a pilot's total annual hours must be flown in a simulator. And a certain percentage of simulator hours can be substituted in lieu of hours in the aircraft. But, there is no empirical data that recommends an appropriate ratio of simulator to live aircraft training. Still, simulators provide a unit commander significant flexibility and cost effectiveness to train the range of pilot skills he is sure to find in his unit.

But, 'it takes money to make money' as they say and the leadership at Fort Rucker, Home of Army Aviation, will have to convince the Army's leadership that it makes sense to spend the millions now for legacy simulator upgrades in order to reap the return on investment not only in operating efficiency, but in a better flight school training, fielded mission rehearsal capability, improved safety (elimination of

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negative habit transfer risk), and overall enhancement of the tools that improve and sustain aviation readiness across the Army.

WHAT DO THE REGULATIONS SAY?

Flight simulators exist to enhance training realism at reduced cost and provide a means to reduce the risks of training tasks inherently unsafe in the actual aircraft. This rational is noted in the Army's Training Device Policies and Management regulation, AR 350-38.

'TADSS are designed and procured to support Army training as defined by the Army long range training plan and CATS [Combined Arms Training Strategy]. They are intended to improve readiness by providing operationally effective training at the institution, home station, or CTCs with state of-the-art technology that will enhance realism, enable training/testing in skills that are otherwise too dangerous or costly or because of environmental concerns and finally to control costs of ammunition and OPTEMPO.'[53]

The legacy simulators provided by the Army to its field forces today are far below the standard imposed by AR 350-38. Flight simulators today are clearly not "state of the art" and as such, realism is reduced, operating expenses are greater than they should be, and negative habit transfer causes safety and readiness concerns.[54] In addition, there are no flight simulators for the AH-64D (Longbow Apache) or the OH-58D (Kiowa Warrior). The lack of flight simulators to support those aircraft adds training cost and risk to Army units with them. Combined with the negative habit transfer of non-concurrent simulator cockpits for the AH-64A, UH-60, and CH-47D, a serious aviation training deficiency exists in the Army. The deficiency affects readiness and safety and shows the intent of AR 350-38 is not being met.

AR 350-38 also establishes Army policy for life cycle management of training aids, devices, simulators, and simulations (TADSS). It charges the Program Executive Officer/Project Managers (PEO/PM) for fielded systems with the responsibility to "Program and budget funds to support changes to fielded TADSS resulting from changes or modifications to the systems they support".[55] In addition, "Programming and budgeting for modifications or improvements to TADSS necessitated by a modification or improvement to the materiel system are the responsibilities of the system PEO/PM (or item manager) regardless of type classification or who manages the logistical support/maintenance for the item."[56] But, as noted in the AATAS FY99, "there is confusion as to who is responsible" at least from the PEO Aviation perspective.[57] Not to over simplify the problem, but it should leave no doubt that our simulators were not viewed as key and essential training devices during the periods of budgetary distress.

In the final analysis, the failure to upgrade legacy simulators is an Army problem. If TRADOC did not submit the requirement for Army approval, the PEO Aviation would likely not have the budget authority to upgrade simulators from existing funds. Because these devices are critical to training, their upgrades and the upgrades of devices in the future must be inextricably linked to the modernization programs upgrades of fielded aircraft. Regulatory and cultural changes in the Army to establish that link is absolutely critical to prevent the current situation from re-occurring with LCT, AVCATT and other devices to be fielded in the future.

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<u>WHAT SHOULD BE DONE?</u>

A systemic and cultural change is required to recognize selected training devices as key and essential to the Army's mission. Although the current AR 350-38 places responsibility on the PEO Aviation for budgeting upgrades to TADSS, no regulatory source has been identified that mandates training devices, such as flight simulators, have upgrades linked to coincide with the modernization plans of the fielded aircraft they replicate. The AATAS strategy notes that the CMS "is an invaluable crew trainer" that saves thousands of flight hours annually as it provides realistic combat mission training and emergency procedures training.[58] If simulators like the CMS are essential to the training of our aviation forces, and therefore the Army's mission, funding upgrades of them should not be an option to dismiss in times of budgetary distress especially when the fleet of fielded aircraft is being upgraded. Therefore, appropriate regulations must be changed to account for such a mandate.

Allocating funds to upgrade simulation devices to remain concurrent with fielded systems such as helicopters or other weapon systems will be money well spent. As an institution, the Army must come to realize that selected training devices are just as important as fielded equipment. In my view, that is the case with our flight simulators, which should generate a cultural change to imbue a new thought process.

This is a departure from current thinking. If AR 350-38 is to be believed, that TADSS are to be 'state of the art', the cultural change for the Army is realizing that critical training devices like flight simulators should be state of the art. As such, they should garner as much priority for upgrades as equipment going to the soldier in the field. They are important because in aviation, simulators provide an essential training medium for all aviation tasks and especially those (emergency procedures) that cannot be performed in the actual aircraft. Enhancements proposed by STRICOM will provide mission rehearsal and network capability in an enhanced, concurrent cockpit configuration, the cost of which will be recouped. Note too, that simulators operate at a fraction of the cost of the actual aircraft. Tasks trained in the simulator will not only cost less they will reduce the time required by a pilot in the actual aircraft to gain proficiency in flight tasks. This view, if implemented, will save training dollars, reduce wear on the fleet, and reduce training risk to the Army's least experienced part of the aviator population. In addition, when fielding a new aircraft or an upgrade to the fleet, upgrading the flight simulator concurrently with the fielded aircraft will provide a training medium for pilots to achieve some proficiency before flying the actual modified aircraft. There is unconfirmed precedent in the Army's special operations community, the 160th Special Operations Aviation Regiment (SOAR - Night Stalkers).

The 160th SOAR supposedly follows a practice of upgrading its simulation devices before the actual cockpit is upgraded. Pilots are well trained by simulator before flying the actual aircraft. The number of flight hours expended in the actual cockpit is reduced as well as risk to gain an acceptable level of proficiency. The endstate to be achieved by this approach is a ready aviation force that leverages simulation and simulators as primary tools to obtain trained pilots and units more efficiently, while retaining effectiveness at reduced overall cost. If the unconfirmed reports of the 160th SOAR simulator

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methods are true, this fundamentally different philosophy has tremendous potential for the Army. It suggests testing aircraft modifications virtually in a simulation device and using it to train pilots in a risk free environment before attempting an actual live flight test. Such a capability should significantly elevate the upgrades simulators and simulation devices to a higher priority for action by Army leadership.

In terms of priority, "There is great Congressional concern for maintaining readiness, just as much concern for acquiring the weapons that will keep our forces technologically superior, and intense concern for protecting the United States against weapons of mass destruction. Consequently, to stay within budget, good, but lower priority programs are being dropped or severely questioned to free up dollars. Thus simulators must justify their acquisition just like every other weapon system."[59] If congress views these devices on par with a weapon system, shouldn't the Army track and require that the devices currently in the field be tracked and reported as a weapon system? To institutionalize the process of simulator upgrades tied to equipment modernization requires cultural and systemic changes. Specifically, three things should be done immediately:

1. Provide a tail number recorded on the Army's master data file for each flight simulator. The U.S. Air Force supposedly follows a procedure of assigning tail numbers to simulators. Once an upgrade to the actual aircraft is approved in the USAF, those aircraft on the master list of tail numbers receive the modification. Therefore, simulators tracked by tail number could provide the means to provide visibility of simulator readiness and help ensures that simulators are included in the modernization process of the actual aircraft.

2. Report the status of the flight simulators and other important training devices on the Unit Status Report at the appropriate command level (Division, Corps or MACOM). This will require a change to AR 220-1, Readiness Reporting. Including simulators in readiness reporting elevates the importance of the device to training and may provide the visibility that gains congressional support that helps the Army succeed in modernization programs during periods of budget distress.

3. Change AR 380-45 to reflect that certain TADSS will be integrated into the aircraft modernization plans and not as a secondary task to follow aircraft upgrades.

4. Provide the PEO Aviation and the Program Managers for respective airframes the funding authorization to perform upgrades to flight simulators when aircraft are being modernized.

5. Mandate cost burden sharing between TRADOC, AMC, and PEO Aviation to provide simulator modernization and keep it linked fundamentally and financially to changes in the actual aircraft.

There may be other recommendations or changes that are inadvertently omitted but that should and must occur to correct the simulator deficiencies that currently exist. Other changes will follow if the Army's senior leadership has the cultural change that recognizes the importance of the Army's simulators and simulation devices now and to its future readiness.

WHAT DOES CONGRESS THINK?

It is apparent that Congress is supportive of legacy simulator upgrades at this time. There are budget surpluses in our national budget and a sound argument well presented is likely to gain the desired support. If Congress were not supportive, the funding to upgrade the UH-60 and CH-47 simulators in Korea, a congressional initiative, would not have been approved. Now, with a foot in the door so to speak, the Army is in position capture and builds upon the congressionally generated momentum. Clearly, the same devices being upgraded in Korea are just as important to the training base of the Army at the Army's Aviation Training Center, as well as other field commands. It is time to implement an aviation simulation strategy that not only upgrades the simulators deemed essential by the Army Aviation Center in coordination with field commanders, but ensures each time our fleet of aircraft receive approved engineering change proposals (ECPs) or other modifications that enhance capability, these same enhancements are added to our training devices.

Although in the bottom line "Congress expects the military's investment in simulators and trainers to pay off in increased operational readiness at reduced cost, and it measures program success in those terms," given the technologies available and the efforts already made to ascertain costs versus benefits gain, the Army can prove upgrades 'pay off' in increased readiness.[60] The Army needs to make simulator upgrade a priority effort while the timing is right to do so.

FINAL THOUGHTS

It is bothersome as to why the Army is not requesting additional funds at this time to upgrade flight simulators given the mood of Congress and the interest of two general officers in the field.

> "The Navy informed the HAC that competitively procuring high fidelity simulators for East and West coast EA-6B bases was feasible and would result in reduced need for aircraft flight training hours, more airframes for forward deployment, and reduced airframe wear. (Develop a standard for simulator vs aircraft) The result was a recommended $60M for the procurement of high-fidelity simulators for EA-6B bases at Cherry Point, North Carolina and Whidbey Island, Washington." [61]

The Army is no less capable of making the point the Navy did in the value of simulators. Although the EA-6B is a low density, high demand aircraft, Army helicopters are also considered to be relatively low density, high demand by the ground commanders that employ them. In comparison to the EA-6B however, the Army has already invested $600 million dollars in simulation devices that require relatively small percentage of the invested amount to greatly enhance their capability, reduce their operating costs, and extend their operating lives. If the Navy can argue the point and get a new system, it would seem that the Army should be able to argue a similar point relative to its existing fleet of simulators and simulation devices.

A recent Army times noted that "President Clinton's proposed $15 billion increase in defense spending is significant, but it is not nearly enough to pay for the growing list of programs that members of

Congress want to add to the fiscal 2001 defense budget."[62] The time to seek upgrades is now because our Congress believes "there is no question that Service-owned simulators represent billions of dollars of capital to be maintained and upgraded."[63]

The Army may be instituting a way to provide input to Congress on the status of simulators. The Army Aviation Warfighting Center was tasked by TRADOC to perform an accreditation review of flight simulators. The information paper attached to the tasking noted that the "issue of concurrency of simulators was an issue" and also noted that "there were differences on whether the non-concurrency in configuration adversely affected training." [64] The highest level of the Army's leadership is apparently trying to determine the scope of the problem that has been of major interest in the field for some time. It is as though the Army was waiting for the development of a 'silver bullet' that makes the simulation strategy problem easier to cope with. There is not likely to be a one size fits all solution. Not all simulators provide the level and type of training required. AVCATT and LCT have their place in realizing a key part of Combined Army Training Strategy.

A strategy that leaves out the legacy systems is flawed and in need of revamping. The future of the Army's aviation force is at significant risk without a strategy that incorporates those programs in development with the upgrade of legacy flight simulators. Failing to implement a workable strategy that upgrades legacy systems now while waiting for the development and fielding of the AVCATT, LCT and other virtual programs perpetuate problems being experienced now by Army Aviation units. The following commentary underscores that point:

> "We need to examine our M&S (modeling and simulation) technical development and implementation strategies so that they stand up to the common sense test of senior leadership. George S. Patton said, 'a good plan executed now is better than a perfect plan next week.' We must carefully construct strategies that affordably exploit the power already available within today's M&S technology, while developing and deploying a solid foundation at the DoD Enterprise level for the future. As one prone to analogies, I offer the following: during your recent air travels you may have noticed an orange or white wind sock at the end of the runway as the airplane taxied into position for takeoff. This windsock is intended to give the pilot an indication of the relative direction and approximate speed of the wind to help anticipate flight dynamics in the takeoff or landing phase. It is not precise, but it is useful and influences near-term pilot actions. It's not very expensive to deploy or maintain, but it is an elegant solution for the information it provides, and you can count on it every time. The bottom line: **the notion that waiting longer to act will provide significantly better M&S strategies, plans or solutions must be recognized as a potential illusion with inherent risk.**"[65]

The longer the Army waits to upgrade the legacy simulators, the less pragmatic its training and acquisition strategy becomes and the more inherent risk Army Aviation assumes in training its aviators. The time to upgrade legacy simulators is now.

CONCLUSION

Aviation equipment modernization programs do not ensure the Army will have a trained and ready aviation force. The Army currently lacks an integrated aviation simulation and simulator strategy

that provides training resources to address fundamental pilot skills and ensures critical training devices are modernized to keep pace with the equipment they replicate. Modernization plans for Army aircraft must also resource the training tools essential to fully develop the potential the new equipment capability brings to the Army. Otherwise, the modernization program has failed to achieve what should be its endstate: a more capable aviation force.

The impact of reduced flight hours and lack of upgraded training devices has contributed to a reduction in aviation readiness and has probably contributed to a rising accident trend. Regulations that govern training aids and devices are partially responsible for the deterioration of flight simulators because upgrades to critical training devices are not mandated or tightly linked to aircraft modernization programs. In addition, the regulations themselves are not well written to fix responsibility for continuing to upgrade flight simulators as appropriate. Training devices, like flight simulators, are essential to the Army's mission and should not be ignored or forgotten during periods of budgetary distress. Adding tail numbers to track simulators and reporting them on readiness reports will provide necessary visibility upgrade dollars.

Flight simulators should provide a combination of visual and motion cues that provide the best training environment in a high-risk profession. An aviation simulation strategy that provides deployable devices while maintaining the fixed base legacy systems for more complete training and the support of stay-behind portions of deploying units provides flexibility to the Army. It also recognizes that is premature to rely on unproven technology to train emergency procedures, the disturbance tasks, that are critical to the safe development of the Army's aviation forces.

Our Amy's culture does not recognize the criticality of certain training devices and their potential for realistic training at dramatically reduced risk and cost. It must change. Flight hours and operating expenses of aircraft and weapons will only become more costly. Flight simulators will provide an offset to the rising costs and provide more capable pilots who can then maximize the live training after learning rudimentary skills in a simulator. But that is only true if the simulators are concurrent with the configuration and capability of fielded aircraft.

RECOMMENDATION

Recognize the importance of flight simulators to the readiness of the Army aviation units and assign tail numbers to them like any other aircraft. The Army should then make it a priority action to upgrade legacy flight simulators and other selected devices and petition Congress for additional funding this year. Further, the Army should identify all critical training devices, report them on readiness reports, and change appropriate regulations (AR 220-1 and AR 385-40) to maintain readiness visibility of those devices to keep them linked with the modernization programs of the systems they were created to replicate. This will improve process efficiency by eliminating a redundant requirements determination process for the simulator that should be part of original plan for aircraft modernization. Sustain the minimum level of flight hour program funding for all airframes at 14.5 hours per pilot per month without

pro-rating hours from certain types of units (CH-47 and UH-60) to plus up others (AH-64). A desired standard for all aircrew crewmembers is 16.0 hours per month for all modern (AH-64, UH-60, and CH-47) airframes. Given the complexity of the aircraft, complexity of the mission, and the mission profiles being flown, the Army should argue that it requires at least parity in flight hours compared to the other services, which enjoy a significant advantage in that area.

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[44] Edward Cook, Federal Aviation Administration, National Simulator Program Supervisor <Edward.D.Cook@faa.gov>, "Simulator Research Project," electronic mail message to Colonel Greg Adams <usma35006@aol.com>, 1 February, 2000.

[45] Training Circular 1-210, Chp. 1, para.1-2.

[46] STRICOM Modernization Requirements Plan, 4.

[47] Ibid, 26, and La Cross Information Paper.

[48] Forging the XXIst Century Warfighter briefing.

[49] Ibid.

[50] Ibid.

[51] Ibid.

[52] Ibid.

[53] Department of the Army, Training Device and Policies Management, Army Regulation 350-38 (Washington, D.C.: U.S. Department of the Army, 15 October 1993), 5 paragraph 4-1 paraphrased.

[54] Ibid, Para 4 – 1.

[55] Ibid, Para 2 – 2.h.

[56] Ibid, Para 4 – 5.c.

[57] PEO Aviation AATAS FY 99, 1 – 2.

[58] Ibid, 2 – 21, paragraph, 2.2.1.6.7.

[59] NTSA Report, paragraph 8.1.

[60] Ibid, paragraph 8.1.

[61] Ibid, paragraph 8.2.

[62]Rick Maze, "Lawmakers say 2001 budget not enough for defense," <u>Army Times,</u> 21 Feb, 2000, 10.

[63] NTSA Report, paragraph 8.1.

[64] LTC Capps, "USAAA Final Report No. 98-145 Rotary Wing Flight Simulators," DAMO-ZS, Office if the Deputy Chief of Staff for Operations and Plans, 15 June 1999.

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